These papers are in good preservation: the writing is clear, and the drawings well-defined. Baron Zach says, that "he compared the corresponding ones with those observed by Galileo, and found betwixt them an exact agreement." This, the author shows, is very far from being the case, and he also brings evidence to prove that the discovery of the spots on the sun was made by Galileo at latest in the summer of the year 1610, and very probably in or before the month of July. He allows, however, that Harriot's observation in December of the same year, was the result of his own spontaneous curiosity.

The first observation made by Harriot of the satellites of Jupiter, has for date the 17th of October 1610. Those that follow, extend to the 26th of February 1612: they are clearly written out on thirteen half-sheets of foolscap. But, even by the statement of Baron Zach, Galileo discovered them on the 7th of January 1610; that is, nearly eight months before Harriot.

The author has detected many other material inaccuracies in the account given to the world by Baron Zach of Harriot's observations. He concludes, however, by observing that Harriot ought not to be deprived of the credit which is justly due to him, because a greater share has by some persons been claimed for him than he is justly entitled to. He himself made no pretensions to priority in the discoveries in question.

May 31, 1832.

DAVIES GILBERT, Esq. D.C.L. Vice President, in the Chair.

The reading of a Paper, entitled, "On the Correction of a Pendulum for the reduction to a vacuum, together with Remarks on some Anomalies observed in Pendulum Experiments," by Francis Baily, Esq. F.R.S.,—was commenced.

June 7, 1832.

HIS ROYAL HIGHNESS THE DUKE OF SUSSEX, K.G. President, in the Chair.

Lord Henry John Spencer Churchill; the Hon. George Charles Agar, M.A.; John Disney, Esq.; James Clark, M.D.; James Hope, M.D.; the Venerable George Glover, M.A.; Michael Thomas Sadler, Esq. M.P.; Lieut. William Samuel Stratford, R.N.; James David Forbes, Esq., and Howard Elphinstone, Esq. M.A., were elected Fellows of the Society. Baron Damoiseau of Paris, Professor de Blainville of Paris, Professor Carlini of Milan, Professor Cauchy of Paris, and Professor Tiedemann of Heidelberg, were elected Foreign Members of the Society.

The reading of Mr. Baily's Paper on the Pendulum, was resumed and concluded.

The author observes, that in all the experiments hitherto made with the pendulum, a very important correction, depending on the influence of the circumambient air, has been omitted; and that the phi-

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losophical world is indebted to M. Bessel for having first drawn the attention of the public more immediately to this subject. For, although Newton evidently suspected that such an influence existed, and although the subject had been since fully discussed by the Chevalier du Buat, nearly 50 years ago, yet it does not appear that any of the distinguished individuals, employed by the different Governments in making experiments on the pendulum in more recent times, have had any notion that the effect of the air, on the moving body, was any other than that depending on its density; and consequently varying in amount according to the specific gravity of the metal of which the pendulum might be composed. But M. Bessel has shown that a quantity of air is also set in motion by the pendulum (varying according to its form and construction), and thus a *compound pendulum* is in all cases produced, the specific gravity of which will be much less than that of the metal itself. M. Bessel's principal experiments for establishing the accuracy of this principle, were made with two spheres, about two inches in diameter, differing from each other very considerably in specific gravity, one being of brass, and the other of ivory, and each suspended by a fine steel wire. The author of the present paper, however, pursued another and a very different course for obtaining the same end: namely, by swinging the same pendulum first in free air, and afterwards in a highly rarified medium, nearly approaching to a vacuum. From the difference in the results, he deduces a factor (denoted by n), by which the old, and hitherto received, correction must be multiplied in order to obtain the new and more accurate correction indicated by M. Bessel; and which, in the case of the two spheres above mentioned, is found by that author to be equal to 1·95.

But Mr. Baily, instead of confining himself to spheres of this size, and composed of these two substances only, has extended his inquiries to pendulums of various magnitudes, substances and forms. His first recorded experiment is on Borda's platina sphere, the diameter of which is 1·44 inches; and he found that the old correction must in this case be multiplied by 1·88 in order to obtain the true and accurate correction; or, in other words, that the old correction was but little more than half what it ought to be. The author then tried three other spheres of precisely the same diameter, but differing considerably in specific gravity: namely, lead, brass, and ivory, all of which gave nearly the same result; the mean of the whole being $n = 1·86$. He next proceeded to spheres of the size used by M. Bessel, made of three different substances, viz. lead, brass, and ivory. These gave a result (agreeing very well with each other,) somewhat smaller than the former; the mean of the whole being $n = 1·75$: thus showing that the factor for the additional correction is due to the form and magnitude of the moving body, and not to its weight or specific gravity. This last value, as the author observes, differs from that deduced by M. Bessel as above mentioned; but the cause of the discordance does not appear.

The author then shows the effect produced on cylinders of various kinds, both solid and hollow, and suspended in different ways,—on

lenses, on cylindrical rods, on bars, on tubes, on convertible pendulums, and on several clock pendulums, amounting to upwards of 40 in number. The results of these experiments give in each case a different value for the factor n; and which appears to depend on the extent of surface, in proportion to the bulk of the body exposed to the direct action of the air when in motion: further experiments, however, are requisite to establish this point in a satisfactory manner*. But, in the author's opinion, enough is shown to indicate the necessity and propriety of a revision and correction of all the experiments hitherto made with the pendulum, either for the determination of its absolute length, or for ascertaining the true figure of the earth; and that for this purpose, the true correction must be found from actual experiment in each particular case; since, with very few exceptions, it cannot be determined by any mathematical deduction.

Mr. Baily then proceeds to point out some singular discordances arising from the knife-edge mode of suspending the pendulum, where the *same* knife-edge and the *same* agate planes are employed. From which he is led to infer that the pendulum furnished with a knife-edge and agate planes, as at present constructed, is a very inadequate instrument for the delicate purposes for which it was originally intended; and that a more rigid examination of that part of the instrument is requisite, before we can rely with confidence on the accuracy of the results obtained by it.

Some anomalies are then pointed out in the magnitude of the arc of vibration, and some remarks offered on the supposed inadequacy of the usual formula for determining the correction for the arc; but the author considers it desirable that further experiments should be made for the more accurate determination of this point.

In conclusion, the author expresses a doubt of the rigid accuracy of the length of the seconds pendulum, as deduced from the recent experiments of Captain Sabine.

To the whole are appended tables exhibiting the details of all the experiments made by the author, and the corresponding results.

A Paper was read, entitled, "Researches in Physical Astronomy," by John William Lubbock, Esq. V.P. and Treas. R.S.

The present paper contains some further developments of the theory of the moon, which are given at length, in order to save the trouble of the calculator, and to avoid the danger of mistake. The author remarks, that while it seems desirable, on the one hand, to introduce into the science of physical astronomy a greater degree of uniformity, by bringing to perfection a theory of the moon founded on the integration of the equations employed in the planetary theory, it

* Since this paper was read, the author has made a number of additional experiments on various other pendulums, which, by permission of the Council, will form part of the original paper; and from which he is led to infer that, in the case of spheres, cylinders, and other bodies suspended by rods of different diameters, the value of the factor depends not only on the body appended to such rod, but that the rod itself has a considerable influence on the result, except it be a very fine wire; when its effect becomes merged in that of the appended body.